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Agricultural Memorandum No 307

Danaus Plexippus in Britain in 1968, and a possible pattern of immigration from 1933 onwards

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Introduction

D. plexippus (the Monarch butterfly) was reported in large numbers in October 1968, and one or two sightings were also made a little earlier; this note considers the probable source of these insects. Discussion with entomologists in general, and Mr R. A. French of Rothamsted in particular, has suggested that the D. plexippus arrivals in 1933 (Hurst, 1968, Ag. Mem. 241) were too numerous to be satisfactorily explained by an origin in the Azores. The sort of source which had been obtained in some earlier flights with the P. biloba for example (New England or further south) had not appeared possible in 1933. In the light of these comments therefore, some earlier years were re-examined.

1968

Monarchs started to arrive in southern and central England from the beginning of October, and the comparatively extremely large number of sixty was observed during the month. Isolated specimens had been seen earlier on 2 (?) August (South Devon), 1 September (Dorset) and 24 September (again Dorset) but main arrivals were from about 2 October onwards.

Brief examination was made of the September dates mentioned, and in neither was a satisfactory source established from outside Europe to the British Isles. No back-track existed to any west or southwest source from 20 July to 2 August (winds were easterly or northerly over the British Isles), and the same was true for the late September arrival. A trajectory was just possible to the Newfoundland area, with arrival in southern England on 1 September, but it is thought very unlikely to have occurred - at least without major insect flight contribution.

The arrivals in early October were however very different, and two separate possible tracks have been drawn, as shown on Figure 1. The more recent arrival (during the afternoon of 29 September) would correspond to passage in comparatively cold air, with a source area in Canada (Labrador or possibly Newfoundland), two-and-a-half days earlier, perhaps at 0001/27, (00.01 GMT on 27th) or a little earlier. Temperatures at 1800/26 in the Labrador area were of the order 14-17°C, and winds were off-shore. The slightly earlier arrival, around midnight 28/29 in southern England would still have been associated with about the same time of departure and is

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parallel in some ways. It would involve a rather more southern point of departure - Southern Newfoundland, or possibly Nova Scotia, though further back-tracks do not lead back to the coast of the USA; temperatures would have been about 17°C or so in south Newfoundland (and about 20°C in Nova Scotia) at 1800/26. This trajectory would involve a fast passage in just over 2 days compared with over 2½ days on the more northern track in a stronger wind flow. The air temperatures for this flight near the surface are somewhat higher, and at a height of perhaps 200 or 300 feet would probably have been in the zone 12-16°C, distinctly warmer than the temperature on the northern flight of 10-12°C (or possibly a little below for a short time in the extreme west).

1933

The numbers of Monarchs reported from about 2 September were consistent with a major invasion at the beginning of the month; Ag. Mem. 241 suggested two waves, in early and mid-September with the Azores as the probable origin of both; America was stated as unlikely but possible. Working on the theory that America must have been the source, the charts were re-examined for August/September, and a reasonably satisfactory back-track for arrival 0100/31 August (in the region of Lands' End) could be established, with origin in the Newfoundland/Labrador area 1200-1800/27; this could represent 3½ days flying time. Any arrival appreciably after 0100/31 could involve an Azores source, and no satisfactory migration back-track was possible much before 31 August. The back-track now suggested would have demanded no flying effort on the part of the insect, but any other departure time from America would have involved real flying (with sustained, uni-directional speeds perhaps up to 10 knots) to get into a suitable airstream. It was mentioned in Ag. Mem. 241 that a second wave might have arrived in the middle of September; any back-track at about this time was poor, and the occurrence of a second wave is in fact very doubtful - but if it had happened, then the Newfoundland area must have been the source.

Earlier arrivals in 1933 included dates 16 and 18 August. These insects might, as earlier suggested, have come from the Azores or Bermuda (or south-east United States) respectively; these again in mid-summer are not particularly likely sources, and a back-track from the Newfoundland area arriving 1300/16 (having departed 0700/13) looks quite feasible. 14 July was explained (Ag. Mem. 241) by transatlantic flight from Virginia or N. Carolina and there is nothing to add, except that almost any trajectory from these areas to the British Isles must inevitably pass close to Nova Scotia and the south of Newfoundland. Earlier arrivals, such as 4/5 July were as satisfactorily explained as possible in Ag. Mem. 241 by a Nova Scotia or Newfoundland source on 24 June; again there is nothing to add to this, nor are there any further comments on the arrival 14/18 June in Lancashire.

Finally, it must be emphasised that the charts and data available in 1933 were nothing like as good as nowadays, and there is consequently a much greater measure of uncertainty about any trajectories.

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It is also useful to review the occasions with several sightings (e.g. apparent migrations) mentioned in Ag. Mem. 241 from 1947 to 1967.

1947

The only occasion was an arrival on 13 September, earlier suggested as migration from a source south of Newfoundland - the Nova Scotia area in fact. This is quite valid, and Newfoundland could be the source.

1948

Arrivals from 14 September were consistent with departure from the New Jersey area. This seems quite valid - with a departure from Nova Scotia or Newfoundland, all very near the same track.

1949

Arrivals 10 September onwards were possible, flying on a very similar track to 1948.

1950-1967

Although the Monarch was seen in most years (but not in 1954, 1956, 1960, 1963 or 1966), it was always in isolation, and no suggestion appeared to exist of a mass flight.

Where in America do Monarchs come from?

It has been noted in the analysis of Williams, Cockbill, Gibbs and Downes (1941) that of 146 sightings of Monarchs in this country from 1824 to 1939, 72 occurred in September, and 23 were in each of August and October. In no other month were double figures reached during the 116 years. A more recent total, due to R. A. French, up to the end of 1967 quotes 98 September arrivals out of 222 reports, and of course 1968 will add a little to the September total, and very substantially to that for October. It might perhaps be true to say that there were more transatlantic trajectory possibilities in September than in any month from about April onwards, but it is not considered that any meteorological difference of trajectory frequency would remotely approach an explanation of the difference in scale of possible migrations.

It has been noticed that nearly all of the September flights which have been analysed since 1933 correspond to an origin in roughly the Newfoundland part of the world - sometimes a little south (Nova Scotia or even New England), and sometimes a little north (Labrador). This may be the latitude where the insects are on the move southwards in late August/September. It is also probably very relevant that the distance from Newfoundland to southwest England is less than from Nova Scotia to England and far less from New England for example. Roughly, distances from United Kingdom to Newfoundland are 1800 nm, Labrador is a little further, Nova Scotia a little further still at about 2200 nm, New England (Massachusetts) 2600 nm, and N. Carolina 3000 nm. Insects departing from east Canada in late summer/autumn would have therefore

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considerably less distance to travel than from N. Carolina and surrounding states in spring, when the Monarch's northward movement is in progress. Moreover, winds on the whole tend to be stronger in the more northern latitudes like 45/50 N than in districts south of New York (at 41°N), and there is less opportunity of synoptic development preventing the occasion of a trajectory. The combination of these factors means that September journeys can easily be less than three days from east Canada (and may on occasion be not much more than 2) whereas 4 days or more could be expected from further south in the eastern states; the term "east Canada" is used, as in nearly all the Newfoundland cases, a further back-track would lead to the mouth of the St. Lawrence or possibly even further west. There is however evidence of some such southern flights in 4 days in favourable conditions (for example, P. biloba in 1954, Hurst, 1965, Ag. Mem. 137) but to the writer, the comparative frequencies of spring and late summer/autumn arrivals of the Monarch may hint at the possibility of much greater mortality on voyage early in the year.

Finally, biological considerations almost certainly reinforce this tendency - southward moving populations in late summer/autumn are much more clustered (and numerous)than those about to fly northwards from Florida, Georgia etc. in the spring.

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Any comments or suggestions on this memorandum should be sent to the author.

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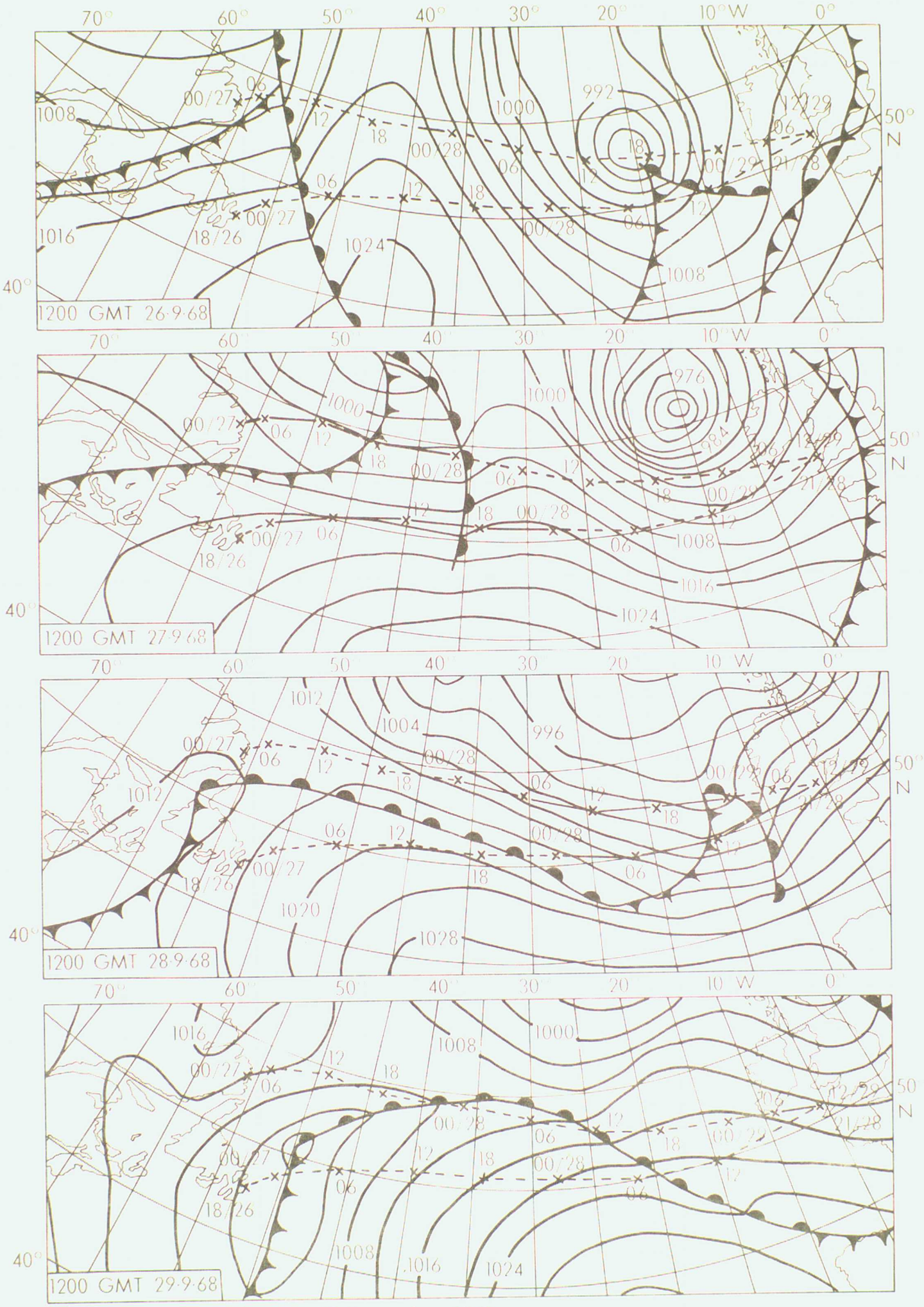

Fig. 1 Atlantic charts for 26—29 September 1968

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